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## IS—Organisation Coevolution and Competitive Advantage: Learning from the Field

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### Abstract

*The business value of Information Systems (ISs) has been claimed and challenged. In particular, achieving competitive advantage through ISs has been predicted but as yet not supported by conclusive evidence. One of the key reasons for the mixed and inconclusive results, it is argued, is conceptual deficiency and the lack of theoretical models that can explain how an IS changes an organisation, so as to impact on its competitive advantage. In this paper we investigate this impact by drawing from a case study of an Investment Banking Company and its core IS. In order to explore and understand the observed changes and the impact on the Company's competitive advantage, we focus on the coevolutionary effects in the development of the Company and its IS. We argue that by viewing the system's development from a coevolutionary perspective, it is possible to identify the subtle ways in which the IS affects the Company, its work processes, production of services and relationships with clients, that in turn impact on the Company's competitive advantage. Moreover, we demonstrate how the IS-Company coevolution framework can assist in exploring future risks in maintaining competitive advantage.*

### Keywords

Organisation—IS interrelationship, IS impact on competitive advantage, IS continuous development, Organisational change, Organisation—IS coevolution

## INTRODUCTION

The business value of information systems (ISs) and how ISs contribute to superior business performance are research questions that continue to trouble practitioners and excite researchers around the world. While many case studies have found that IS capabilities are differentiating factors among successful and less successful companies, others have found no discernible link between investment in IS and companies' business performance (Baharadwaj, 2000; Beath et al., 1994; Clemons, 1986; Marcus & Soh, 1993; McKeen & Smith, 1993; Strassman, 1997). The difficulties in establishing this link result from both methodological problems and theoretical limitations. Problems such as inappropriate measures and variables, the inability to control external factors that impact on company performance, sample size and selection, among others, have been mentioned in the literature (Brynjolfsson & Hitt, 1993; Mooney et al., 1995). More fundamental, however, seem to be issues of a conceptual nature. There is a wide recognition that better theoretical models are needed to explain the ways and mechanisms by which an IS affects company performance (Baharadwaj, 2000; Beath et al., 1994; Marcus & Soh, 1993) and in particular a company's competitive advantage (Powell & Dent-Micallef, 1997).

In this paper we explore the relationship between continual IS development and company transformation, leading to increased competitive advantage. We explore this relationship by drawing from a longitudinal field study in the Equities Division of an international Investment Banking Company. The field study focused on the Company's core Research IS that has been continuously developed by an in-house team. By examining the evolution of the Research IS and the ensuing changes in work processes, production of services to clients and, more broadly, in building and maintaining relationships with clients, we aim to gain a deeper and more grounded understanding of the changing nature of the Company's competitive advantage. Furthermore, throughout the analysis, as we learned from the field, we identified that not only has the IS's evolution impacted upon the Company's processes, but also that the Company's changing processes and the nature of its competitive advantage have in turn affected a particular evolutionary path for the IS.

The purpose of this paper is to advance understanding of the nature of IS-organisation relationships as they impact upon a company's competitive advantage. More specifically, by exploring the Research IS and its co-emergence with the Company, we aim firstly to explain the transformation processes taking place as a result of the continuous development of the IS; secondly to explain the changing nature of the Company's competitive advantage; and thirdly, to demonstrate how an IS-organisation coevolutionary framework might contribute to a deeper understanding of these changes.

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To achieve these objectives, in the following section we will briefly discuss the sources of competitive advantage, especially in the investment banking industry, and the ways an IS can be seen as relevant to competitive advantage. This is followed by the explanation of the research methodology and presentation of the field study. Interpretation of empirical data from the study, the effects of coevolutionary forces and shifts in the Company's competitive advantage, are discussed in Section 5. Implications for IS development and conceptualisation of IS-organisation interrelationships are briefly discussed in the conclusion.

## **COMPETITIVE ADVANTAGE AND INFORMATION SYSTEMS**

Within the popular management literature (Porter, 1980;1985), the notion of competitive advantage has received considerable attention. Most regularly, the means by which competitive advantage may be secured are considered in terms of becoming a cost leader or through differentiation of the product. Neither of these avenues, however, would appear from our research to be directly applicable in the financial services context. Investment banking, like other parts of the financial services industry, has products that are easily imitated and product costs that are difficult to calculate (Knights, 1992). We would argue, that a more appropriate direction from which to think about competitive advantage in the investment banking context, may be found in Drucker's (1993) discussions of post-capitalist society and new research on intangible assets.

Drucker's central thesis relates to changes, over time, to the primary factor in the generation of wealth. Drucker argues that present approaches to managing organisations are in a period of transition from post-war industrialism towards the age of the 'knowledge worker' and knowledge organisations. Knowledge workers will be the "leading social groups of the knowledge society...knowledge executives who know how to allocate knowledge to productive use - just as the capitalists knew how to allocate capital to productive use" (Drucker, 1993, p. 7).

Arguably, the investment banking industry has always been a knowledge-based industry. Indeed, management in this industry, including those in our case study Company, believe that their competitive advantage lay firmly in the hands of the analysts and the relationships they maintained with their clients. Consequently, in order to increase and sustain their competitive advantage, investment banking companies rely implicitly on their ability to manage their intellectual capital (Edvinsson & Malone, 1997) and intangible assets (Sveiby, 1997). By recognising the role of Information Technologies (IT) and IS in these processes, understanding of the sources of competitive advantage has been gradually changing. There is a recognition of so-called IT-enabled intangibles, human IT/IS resources, and IS capabilities that evolve over time and are difficult to imitate, thereby serving as new sources of competitive advantage (Clemons, 1986; Powell & Dent-Micallef, 1997).

An important characteristic of these IT or IS-enabled intangibles is their emergent nature. They evolve and impact on organisations that themselves evolve and in turn impact on the IS. In order to explore new sources of competitive advantage in the knowledge economy, and in particular the changing nature of competitive advantage in the investment banking industry, we propose viewing the 'IS-organisation' as a complex that coevolves as it adapts to the environment. The notion of coevolution, as distinct from evolution, acknowledges that organisms rather than simply adapting to their surrounding environment, *co-evolve* with it – each affecting change to the other. Here we see coevolution of an IS and the organisation creating what we consider to be an IS-organisation complex, on one hand, and coevolution of this complex with its environment, on the other. From a broader perspective these may be seen as processes by which the organisation, its IS and environment change together, each influencing the form of the other (Baum & Singh, 1994). The coevolutionary framework, that we use to explore the changing nature of competitive advantage in our field study is developed from and informed by several streams of research in IS (Truex, Baskerville & Klein, 1999; Cecez-Kecmanovic & Kay, 2001), technology evolution (Rosenkopf & Tushman, 1994; Rosenkopf & Nerkar, 1999, Campbell,1965), organisation-environment relationships (Aldrich, 1972; Aldrich & Pfeffer,1976; Gordon, 1991; Baum & Singh,1994), organisational ecology (Hannan & Freeman,1977; Carroll, 1988), and processes of selection and retention in organisations (Ginsberg & Baum, 1994; Miller, 1999).

In order to consider the processes underpinning the IS-organisation complex the use of ideas from the multi-level coevolutionary literature is particularly useful. In this paper, we will draw specifically on Rosenkopf and Nerkar's (1999) description of multi-level coevolution and the notion of product hierarchies. In their discussions of technological evolution they view "...the evolution of product hierarchies as the result of variation, selection, and retention processes (Campbell, 1965) enacted by organisational entities on underlying technological know-how". The hierarchy described is composed of 3 essential levels: components, products and systems. Although their discussions relate specifically to the evolution of technology only, we will apply it in a socio-technical context. The three levels provide a framework for describing the processes by which the IS and organisation may be seen to coevolve.

## **RESEARCH SITE AND METHODOLOGY**

The field study described in this paper has been taking place in the Australian branch of the Equities Division of an International Investment Banking Company since 1999. The study focuses on the Equities Research Department, which provides market and company analysis to two main internal clients: Equity Sales (responsible for brokering shares to institutional investors) and the Investment Banking Division (who assist external clients in the raising of capital). As such the Equities Research Department does not directly generate revenue for the company itself but supports the other departments, who's competitive advantage is dependant on the ability to provide high quality research to attract and retain clients. The Research Department consists of approximately 50 people, including; directors, analysts, research assistants and clerical staff, grouped by industry sectors, e.g. resources, IT&T, banking & finance. Each sector group is responsible for the provision of research on listed companies that fall within their sector. There is also a small group of analysts responsible for the provision of macro economic information, e.g. interest rate forecasts, commodity prices and foreign exchange rates. As a cost centre, the Equities Research Department has a significant budget, with many analysts earning several hundred thousand dollars per year and top directors earning over one million dollars per year. Positions are highly competitive and strongly linked to performance.

The Research Department also includes an IS team composed by 1 director; 2 technical support staff who have both IT and financial knowledge; 4 programmers and 1 computer trainer. The role of the IS team involves system development, technical support for the analyst's when they experience difficulties, training of new recruits on how to use the system and gaining the analysts' 'buy-in' to the system.

In 1995, to improve the Company's research performance and make 'products' more easily accessible for clients, the design of a Research IS, which for the purposes of the paper we will call 'Omega', was initiated. As part of a collaborative research grant, our task was initially to investigate and suggest ways of improving Omega's use, to study its impact on both research performance and the satisfaction of client needs. However, as we progressed our task changed to consider the broader implications of Omega including its impact on the Company's competitive advantage. Therefore we investigated the broader context of the investment banking industry and the global operations of the International Investment Banking Company in which our case study organisation resided. We also investigated other proprietary ISs within the Company, their use and impacts. In the local context we investigated changes evolving in the work practices of analysts and research assistants and also changes in the provision of services to clients. We observed changes in the way clients interacted with the Company and its analysts, due to Omega's development, that had significant impacts on the nature of client relationships with the Company. Observation of Omega's development continued as Omega itself experienced continuous evolution as a function of the multitude of organisational changes.

The nature of our enquiry and our own beliefs, and values influenced our choice of the research methodology. As we believe that our knowledge of reality is socially constructed and that actors in the processes we observed create and recreate their subjective and intersubjective meanings through the interactions with the world around them, we adopted an interpretivist lens for our study (Myers, 1997; Trauth, 2001, Walsham, 1993). We needed to explore below the surface and reveal hidden processes and influences so that we could understand the mutually influencing transformations of the Company and its IS. However, while an interpretivist approach was adopted, the specific details of the research methodology emerged as our tasks and understanding of the issues changed. Moreover, given the extreme complexity of the phenomena observed we needed to consider a broad range of theoretical perspectives, as briefly presented in the previous section, to inform our interpretations and deepen our insights into IS-organisation relationships, which in turn determined data collection.

As outsiders to the Company we used non-participant observation techniques, mostly through semi-formal and formal (meeting) discussions with members. This involved collecting and documenting participants' understandings and interpretations of the complex issues involved in the mutual relationships between Omega's development, the Company's performance and its changing business models. We collected and analysed some selected documents and e-mails related to the development and use of Omega. We also conducted one survey and 12 semi-structured interviews focusing on the problems experienced by specific analysts and developers.

Combined these various forms of empirical data formed a 'rich picture' (Checkland, 1981) of the complex interrelationships taking place within the case study context and allowed us to chart the simultaneous changes that were occurring in the organisation, to the IS and, as will be discussed below, to the Company's competitive advantage.

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## FIELD STUDY: THE EVOLUTION OF THE OMEGA INFORMATION SYSTEM

Omega's development was and continues to be ongoing with the system's evolution best conceptualised in terms of 3 broad phases, each distinguishable by social, functional and technological characteristics (see figure 1) and each also indicating an increase in the complexity of the IS—organisation interaction.

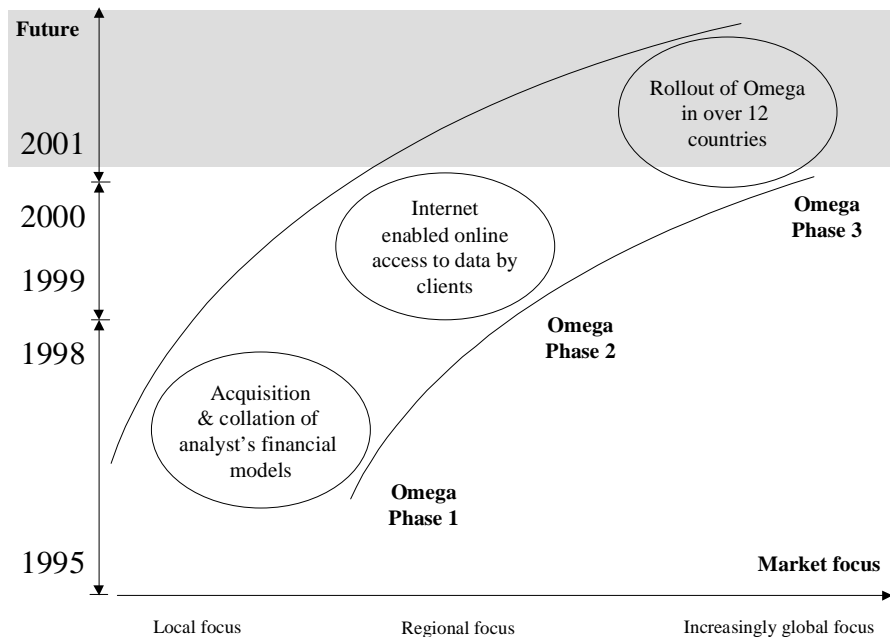


Figure 1: Three Phases of Omega's Evolution

### Phase 1: Collection of Analysts' Models and Semi-automated Report Production

During Phase 1, Omega consisted of the collection of data sets and projections from the analysts' financial models. These models of a listed company's financial performance were previously maintained individually as spreadsheets on the analysts' own PCs. With Omega's development, the data from each of the analysts' models was collected and stored in Omega's database. The analysts' data were formally checked prior to being uploaded into Omega, to ensure the accuracy of projections. These data were processed to produce paper-based reports (newsletter style) for distribution to clients. During Omega's early development, the focus was primarily on servicing clients, with extensive market research undertaken to ascertain the breadth and depth of information clients required. Consequently, its impact was clearly assessable in terms of timeliness, accuracy of reports, client satisfaction, numbers of new clients, and increased profit.

Throughout Phase 1, which lasted approximately four years, various additions were made to Omega's functionality. The most significant of these included the addition of market information (some purchased in the form of live information feeds from external information providers) that the analysts could use as a resource and an 'in-house' designed and built workflow enabling the coordinated and semi-automated production of reports.

From the beginning of Omega's implementation, analysts displayed resistance to the system. Although input from analysts and research assistants was sought during the system's design, the analysts were not prepared to spend time working on what they considered to be an unknown and, in terms of their own work, 'unnecessary' system. Despite their lack of cooperation in Omega's development many analysts complained about Omega's complexity and the structure of the database, they argued that the designers didn't understand the meaning of their financial models or the processes involved in analysing the financial performance of companies.

Nevertheless, by the end of Phase 1, Omega had evolved into a highly complex IS, capable of producing over 150 different types of reports for clients, some on a daily basis. Omega also provided the Research Department with an information resource which directors and analysts could access to gain various financial data. According to people from both within and outside the organisation, Omega was considered to be the state of the art amongst similar proprietary systems developed by competing investment banks. The apparent success of Omega's development, given the strong resistance of its users, was initially difficult to understand. Traditional models of

IS development did not make sense in this context and it was clear to us that other theoretical perspectives were needed in order to make sense of the emerging situation.

### **Phase 2: On-line access by Clients via the Internet**

Phase 2 of Omega's development was characterised by the addition of on-line client access to parts of Omega over the Internet. Furthermore, key clients could make special requests for information, not normally included in the analyst's reports, via Omega's support team. Satisfaction of these requests often required analysts to feed further data into the system and were associated with strong resistance from analysts who were forced to spend considerable time updating their spreadsheets such that the additional information could be fed into the system. Omega, under normal circumstances, only draw selected data from the analysts' financial models. Analysts, in order to gain a comprehensive understanding of a company's financial status, would use a broader set of data that would allow them to undertake more sophisticated analyses than those presented in Omega's reports. The analysts felt that the information, being requested ad hoc, should already have been collected by Omega and that they were in many ways victims of a "poorly designed system".

Omega's increasing complexity (with new functions added on a weekly basis) was a real issue even for the most technically competent analysts. Compared to competitor's proprietary systems, (according to analysts with experience of both Omega and the proprietary systems of other firms) Omega was more comprehensive and complex. As one of these analysts commented, "The systems of other firms are like a regular family car, they're easy to drive but limited in terms of their capabilities. Our system is more like a Ferrari, a bit harder to drive, but in the hands of a skilled individual capable of much higher performance".

Despite continuing complaints from analysts', a survey we conducted in 2000 showed 71% of directors, analysts and research assistants felt that Omega contributed considerable value to their overall performance (less than 5% claimed no value for their individual performance) (Kay & Cecez-Kecmanovic, 2000). These results were also confirmed through interviews with analysts and showed that Omega positively influenced the performance of the Research Department. Moreover, Omega was now considered an important dimension of the company's product portfolio, drawing its own income stream from subscription to the reports it produced.

Phase 2 also brought a shift in focus from the local market, essentially Sydney and Melbourne, to the region, i.e. Australia and New Zealand. Both shifts in complexity and in focus required an expansion to Omega's support team, with the addition of an extra programmer and trainer.

### **Phase 3: Globalisation**

Phase 3 of Omega's development is currently underway, with the system being rolled out in 12 other countries. To this point in Omega's history, its development and use has been limited to Australia, and New Zealand. Historically, different branches of the Company across the globe had been given autonomy with regard to the ISs they used or developed, a situation resulting in a number of competing and incompatible systems. In late 2000, however, Head office in New York determined that all branches of the Company should implement a single global system (one developed in Head office).<sup>1</sup> In the period before the launch of the Head Office IS, however, a number of countries chose to adopt Omega instead of the official system, practically creating a race between the two systems. The impact of these decisions on the global organisation are unknown at the time of writing, however, there are significant implications for Omega's operation, its continued development, the role of its support team and, we would argue, the competitive advantage of the Company overall. In order to examine these implications, in the next section of this paper we will consider Omega's development in terms of the coevolutionary literature.

## **INTERPRETING THE FIELD DATA: IS-ORGANISATION COEVOLUTION**

The implications of Omega's continuing development on the Company's performance have been recognised by the Company's management since phase 1. These have included increased speed to market, more accurate and timely information, improved response to client's requests, increased client numbers and greater interactivity with the Omega's information available to both internal and external clients. What has not been recognised though is the broader impact on the Company and its position globally. In this section we will first examine how both the Company and Omega may be seen to co-evolve and second the implications of this process for the relationship between the Company's competitive advantage and its IS.

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<sup>1</sup> How the decision was made and why Omega was not even considered is beyond the scope of this paper and is omitted here. It should be noted, however, that Omega was widely considered a better system within the company.

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### The Effect of Coevolutionary Forces

In adapting Rosenkopf and Nerkar’s (1999) framework of three evolutionary levels, component, product and system, from a purely technical context to the socio-technical context of our investment bank, it is important to note that we conceptualise a *component* as being social, socio-technical or technological in nature. Omega may be viewed as an example of a component, being socio-technical in nature. It represents one part of the service provided to clients of the bank and has, to some degree, its own observable developmental path. The development of a new methodology for valuing intellectual property, developed by an analyst, would represent another component in the firm’s product or service and would likewise have its own observable developmental path.

As such there are a number of “component-specific” communities operating within the organisational environment of the investment bank, each producing their own observable evolutionary paths. Historically, within our case-study firm, these component-specific communities operated almost completely autonomously, on a local (geographical) level rather than across branches. This produced a rich variety of innovation across the Company, but with limited sharing of that innovation between branches. As such Omega’s team was limited to the Sydney and Melbourne offices, whilst other teams were working on different (possibly technological or financial) innovations in the London or New York offices. “For a given product, then, multiple communities are involved in the technological evolution of the product because products are composed of multiple components” (Rosenkopf & Nerkar, 1999, p.171).

In the context of our investment bank, any number of components may be brought together in order to produce a product. A product is in essence what the client receives. Examples include; advice from an analyst who is using Omega to produce research output on a company; reports produced by Omega; information clients receive by interacting with Omega online. The investment banking *product*, therefore is *socio-technical* in nature, it involves the application of both technology and the knowledge of personnel. “Unlike component-level evolution that results from diffuse community activity, the locus of *product* level evolution rests squarely at the level of the firm” (Rosenkopf & Nerkar, 1999, pp171). In terms of our case study, this refers to the branch level of the investment bank, rather than the international entity. The reason for this is that the Australian branch, like other branches, has its own clients, its own products and to date has operated with relative autonomy in regard to the setting of policies and standards, from its head-office in the US. In the context of the international entity, the implication of these multiple evolutionary paths is that the Company finds itself with a number of similar products, based upon different *component*-level and product-level evolutions. These developments are further illustrated in Table 1 below.

Phases of Development	Phase 1	Phase 2	Phase 3
Function	* Collection of data from analysts’ spreadsheet models into a DB * Publication of reports by processing data from the DB	* Internet access to Omega * Online access by clients to reports * Workflow support for report production	* Global access to information/ analysis * Improved online access by both internal and external clients * More corporate clients
Geographic Focus	Local	Regional	Global
Level of Product Hierarchy	Component/Product (emphasis on component)	Component/Product (emphasis on product)	Product/System (emphasis on system)
Key relationships	IS team vs analysts	IS team vs analysts IS team vs clients	IS team vs analysts IS team vs clients
Innovative forces	Tension between IS team and analysts	Tension between IS team, analysts and clients	IS team locally vs Head office IS team Tension between IS teams
Competitive Advantage	Analyst-client relationships	Analyst-client relationships supported by Omega	Combined effect of caliber of analysts employed, IS quality and IS-Company interconnectedness and harmonious coevolving

Table 1: Omega’s Development Phases, Coevolutionary effects and changes in the nature of competitive advantage

Rosenkopf and Nerkar observe, that over time evolutionary pressures at the *component* and *product* levels can force *System* level evolution. *System level* evolution is characterized by the setting of policies and standards for a type of technology. In the context of our case study, this refers to the standardization of products and services across the Company’s operations. That our investment bank is currently experiencing *system* level evolution is manifested in the Head Office decree that everybody should only use one type of research IS. It is important to note, however, that whether convergence onto a single standard is achieved through this (imposed) approach or self-organises onto a different standard is not known. Arguably Omega’s rollout and adoption across 12

countries and potentially many more in the near future may be the evolutionary path which produces the eventual standard. As we can see the coevolutionary paths of these two systems reached the stage at which they were subject to *selection* at the system level.

Through the 3 Phases of Omega's development, what may be observed are shifts in the levels of organisational variation, selection and retention. As Omega has become more complex, the selection processes acting upon its continued development have gradually spread across the product hierarchy, from the *component/product* levels with emphasis on the *component* in Phases 1, to the emphasis on the *product* level in Phase 2, to the emphasis on the *system* level in Phase 3 (Table 1). These processes may move up or down the hierarchy. For example client feedback on the product (at the *product* level) may cause new *component* level innovations (i.e. new functions added to Omega, or new accountabilities for analysts), leading to further product changes (i.e. new processes by which the client receives information) and potential changes at the *system* level (i.e. new standards of practice for analysts).

By interpreting Omega's development within the coevolutionary framework we revealed the subtle, typically not visible processes, taking place simultaneously at multiple hierarchical levels, by which Omega and the Investment Banking Company coemerged. By following coevolutionary processes we were able to understand how the Company and its IS turned out to be a more tightly coupled complex. As we have seen from Phase 1 till 3, Omega has gradually penetrated a large part of the Company, not only in terms of geography, but more importantly in terms of its core business, becoming intertwined with all the service providing processes. As a result of this coupling the relationships with clients transformed, (which could be viewed as coevolution with the environment), thus affecting change to the nature of the Company's competitive advantage and the process by which it is maintained.

### Shifts in Competitive Advantage

In order to examine the changing nature of the Company's competitive advantage, it is necessary to first understand the previous sources of that advantage. Historically, the Company's clients had held direct relationships with the analysts, with customer loyalty directly related to the calibre of analyst's the firm employed. Whenever an analyst left, their key clients were likely to leave with them, there was little - to no brand loyalty. The Company's competitive advantage lay clearly in the hands of its analysts. Following Phase 2 of Omega's development, however, it was possible for clients to receive market information without ever speaking to an analyst. While analysts remained a key source of knowledge, the increasingly prominent role of Omega in mediating client—analyst interaction was gradually changing the way in which clients viewed and received the services of the investment bank.

It is not surprising that to some analysts, Omega's development was viewed as a threat to the sovereignty of their knowledge, and their unique role in the organisation. This point did little, however, to change the state of the firm's competitive advantage. By far the greater majority of clients were still attracted by the analysts the firm employed. A less obvious impact on the company's competitive advantage was that the presence of a high quality information system attracted higher calibre analysts to work for the brokerage house. The reason for this may be found in the structure of the investment banking industry.

The esteem with which an analyst is viewed, relates to their ranking. An analyst's ranking is a function of a number of factors, including the strength of their relationships with their subject companies, and the associated quality of information that they have access to. This in turn relates to the quality of service that a client may expect to receive. The quality of research an analyst is able to provide to their clients is affected in no small part by the systems the firm makes available to them. As such, not only were clients coming to rely on Omega for the provision of timely and comprehensive industry data, but so too were the analysts themselves, in order to maintain or improve their ranking.

Through Omega's continuing development the nature of client relationships was gradually shifting from the personal relationships of the analyst alone, to a complex of the analyst and the information systems that support them. Similarly, the competitive advantage of the firm was shifting away from the quality of the analysts alone, towards a combination of the analyst's skill and their use of the IS, which implies an increased embeddedness of the IS into the firm's work processes, indicating an increased level of IS-Organisation cross-fertilisation. In many ways this observation is consistent with Hart's (1995) thesis that the competitive advantage of the firm can only be maintained if the capabilities that create its advantage (in this case the analysts) are supported by resources that are difficult to duplicate (Omega and its development process). This observation has significant implications as Omega moves into the third phase of its development. Although the system is currently ahead of the competition in terms of technology, the systems of the other firms will soon be in a position where they are able to offer a similar service, consequently, how to maintain the research department's competitive advantage through the continuous rapid evolution of Omega and the business at a global (*System*) level, becomes a

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significant issue. As Baum observes "...evolution is faster and more effective at lower levels of organisation. The reason for this is that variation, selection, and retention processes unfold more quickly at lower levels of organisation". (Baum, 1999, pp114).

At branch-level *product* development, variation, selection and retention of innovations had been maintained through path-dependant processes of exploration and exploitation (Cohen & Levinthal, 1990; Helfat, 1994). During Phases 1 and 2 of Omega's development, these processes were supported by and directed through the relationships held between the analysts and Omega's support team. Changes to Omega were effected rapidly, resulting in rapid increases in functionality and in the complexity of the system. This is consistent with Truex et al's, (1999) ideas of emergence, as the system was under continuous redevelopment. The future of the system will need to rely on different processes, however, as the patterns of human interaction described above will no longer be sufficient.

If the globalization of Omega continues, the team will effectively be moved to a higher level in the organisation, i.e. their focus will become multi-regional rather than limited to a local market. It should be noted that Omega's team was considered part of the Research Department – not IT, and as such they have not needed to bridge the organisational communication barriers that often exist when labour is divided into different functional departments. Coevolution of the Omega-Company complex will rely on the team's ability to mediate change across the 3 levels of the product hierarchy, such that *component* level developments continue to positively affect evolution at the *product* level whilst maintaining consistency across the global *system*. Furthermore it will need to overcome the suboptimising effects of competition between individuals at different levels of the organisation and different locations around the world. "If an individual or group can choose competitive moves that give larger immediate rewards than corresponding cooperative moves, competitive moves will be selected, even though their contributions to organisational fitness will be lower than those of cooperative moves" (Baum, 1999, p. 114). For example, different regional markets, managed by regional power structures, may require design and/or functionality changes not appropriate to all regions. One of the impacts of this is that the system's evolution "may lead to firm-level dysfunction" (Campbell, 1994, p. 23).

To date, the suboptimising effects of competition have actually supported Omega's coevolution in the sense that they were one source of a creative tension between Omega's team and the analysts. The analysts, acting on self-interest, demanded new functions, or modifications to the functions proposed by the team, whilst the team tried to both respond and pre-empt the analysts requirements. The combination of different functional sets of expertise (IS developers and analysts) consequently supported an environment of innovation (Nonaka, 1994) as the Omega team translated the analysts' needs into new IS functions and capabilities. Now new processes for the mediation of this process will be needed.

Developing new processes will not be easy as the relative success of the developmental approach adopted thus far has further unconscious impacts on the selection and retention processes observed. As Ginsberg and Baum observe, "each time an organisation engages in a particular kind of change it increases its competency in making that type of change. The more experienced an organisation becomes with a particular type of change, the more likely it is to make further changes of a similar nature – because it knows how to make them" (Ginsberg & Baum, 1994, p.128). In the case of Omega, we would argue the danger exists that selection and retention processes well suited to the local branch level will be inappropriately applied at the global level of organisational evolution threatening the competitive advantage of the firm.

Other brokerage houses operating at the local level will have the opportunity to evolve their systems faster and with more local relevance unless these issues can be addressed.

## **CONCLUSION**

Through the description of a case study in the investment banking industry, we have discussed the changing nature of IS-organisation relationships. Specifically, by longitudinally studying the relationship between a Research IS, its users and its Company's clients, it has been possible to describe the way in which these entities coevolve overtime, to produce what we have termed an IS-organisation complex. We described how by viewing the IS's coevolution with the organisation in terms of Rosenkopf and Nerkar's product hierarchy, it is possible to explain the way in which changes to the IS and organisation effect each other in an ongoing cycle of change. Changes in the IS leading to changes in business practice, leading to further changes in the IS and so on.

A key implication of viewing the IS-organisation relationship from this perspective, has been the opportunity to observe and understand both the impact on, and the changing nature of the Company's competitive advantage in the market place. The increasingly important role of the IS in relation to the Company's competitive advantage was observed to extend far beyond the normal parameters of improved efficiency and communication, to include the Company's ability to attract high quality staff, maintain stronger client relationships, increase the range and quality of products provided, and directly contribute to the profit of the organisation. Furthermore, by examining

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the changing nature of these relationships from a coevolutionary perspective, we were able to draw a deeper understanding of the processes that underpin the maintenance of the Company's competitive advantage.

The continuous development approach adopted by our case study Company provided the basis for the co-emergence of the IS-organisation complex. As discussed this was based upon ongoing processes of variation, selection and retention (Campbell, 1965) acting within the IS and organisation as a whole entity, however, only through understanding the situation from a coevolutionary perspective was it possible to gain an understanding of how changes to the Company's competitive advantage had emerged and may be maintained in the future. These observations raised a number of issues that we would argue the organisation will need to address if its competitive advantage is to be maintained. The ability to maintain existing processes of variation, selection and retention as the evolutionary process moves to the *system* level of the product hierarchy will be crucial if our case study firm to compete in both local and international contexts simultaneously.

Future research will need to focus on new approaches to addressing these issues, including the organisational structures developed to support ongoing IS development; the political impacts of an increased user base with increasingly diverse needs and, the ongoing importance of the organisational environment and the means by which the organisation relates to it.

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